EXTRACTION AND PURIFICATION METHOD OF ACTIVE CONSTITUENTS FROM STEM OF *LONICERA JAPONICA* THUNB., ITS USAGE FOR ANTI-INFLAMMATORY AND ANALGESIC DRUG

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates to an extraction and purification method of active constituents from honeysuckle (*Lonicera japonica* Thunb.) and its use, more particularly to an extraction and purification method of active constituents including sweroside from honeysuckle stem (stem of honeysuckle where leaves are removed) by removing tannins, hardly soluble flavonoids, saponins, and the like. Thus obtained active constituents have better anti-inflammatory and analgesic effect, are safer and more stable than the conventional active constituents obtained from honeysuckle flower or honeysuckle leaves, and include sweroside which is an effective active ingredient of anti-inflammatory and analgesic drug.

The honeysuckle (*Lonicera japonica* Thunb.) is a semi-evergreen viny shrub that grows naturally at the feet of mountains or levees in the range of an altitude of 50 to 600 meters in Japan, China and Korea. Its flower bud (honeysuckle flower) and stem (honeysuckle stem) are used as herbal medicines for promotion of urination, detoxification, hemostasis, blood purification, treatment of tumor, edema treatment, cold, diarrhea, emesis, and the like [Illustrated Book of Korean Flora, Chang-Bok Lee, 709, 1989, Hangmun Publishing Co., Seoul; Standard for Herbs

(Herb Medicines) Not Covered by Korean Pharmacopoeia, Hyung-Joon Chi, Sang-In Lee, 87, 305, 1988, Korea Medical Index Co., Seoul; Resource Plants in Korea, Tae-Kyung Kim, vol. 4, 148-149, 1996, SNU Press, Seoul]. Also, many traditional Chinese medicinal books including Sasang Constitutional Medicine and Gwangje Bigeup teach that it is good for treating a variety of inflammatory abscesses inside and outside human bodies [Sasang Constitutional Medicine for Chosun People, Yenben Chosun Medical Institute, 276, 1991, Yeogang Publishing Co., Seoul; Gwangje Bigeup, Kyung-Hwa Lee, 349-351, 1991, Yeogang Publishing Co., Seoul]. It has long been used as a folk remedy for treatment of upper respiratory infections such as cold, tonsillitis and neuralgia for its anti-inflammatory and analgesic activity. Recently, the inflammatory and analgesic activity of honeysuckle has been proved through a variety of experimental animal models, and its effective physiologically active constituents have been isolated and reported to the academic circle [Development of the vegetable anti-inflammatory medicine: Comparison of anti-inflammatory and analgesic actions of the honeysuckle extract, Song-Jin Lee et al., *Korean Journal of Pharmacognosy*, 363-367, 25, 1994; Flavonoids from the aerial parts of *Lonicera japonica*, Son et al., *Arch. Pharm. Res.*, 365-370, 15, 1992; Antiinflammatory activity of *Lonicera japonica*, Lee et al., *Phytother. Res.*, 445-447, 12, 1998; Triterpenoid saponins from the aerial parts of *Lonicera japonica*, Son et al., *Phytochem.*, 1005-1008, 35, 1994 ; Anti-inflammatory activity of the major constituents of *Lonicera japonica*, Lee et al., *Arch. Pharm. Res.*, 133-135, 18, 1995].

Description of the Related Art

To date, hydrolyzable tannins such as caffeoylquinic acid, methyl caffeate, chlorogenic acid and iso-chlorogenic acid, and iridoid glycosides such as loganin, sweroside, vogeloside and epi-vogeloside are known as effective active constituents contained in honeysuckle stem. Most conventional researches have been centered on honeysuckle flower and honeysuckle leaves. It should be noted that honeysuckle stem has a different distribution of constituents from honeysuckle leaves or honeysuckle flower. That is, unlike honeysuckle stem, major constituents of honeysuckle leaves or honeysuckle flower are flavonoids, such as lonicerin, rhoifolin and ochnaflavon, triterpene saponins having hederagenin or oleanolic acid as non-sugar constituent, and various hydrolyzable tannins.

These constituents are hard to be prepared into an injection. If the injection is rich in polymer tannins, they may bind to other constituents thus resulting in coprecipitation, and may bind to serum proteins in the blood to form hardly soluble precipitates, which can be a cause of angiostenosis. In addition, since flavonoids included in honeysuckle in general are insoluble to water, a fairly large amount of organic solvent or other agents which mediate dissolution are necessary to dissolve them to the level higher than the effective concentration. Also, active constituents rich in flavonoids are extremely insoluble in physiological salt solution for injection and may become unstable if stored for a long time in an alkaline buffer solution. Lastly, saponins obtained from honeysuckle, particularly monodesmosides, are known to have strong hemolysis properties.

Therefore, they cannot be injected directly into the vein without purification [Studies on the saponins of *Lonicera japonica* Thunb., Kawai et al., *Chem. Pharm. Bull.*, 4769-4775, 36(12), 1988]. Honeysuckle leaves and honeysuckle flower are greater in tannins and hardly soluble flavonoids than honeysuckle stem. In the acute toxicity test for injections, they confer more toxicity than honeysuckle stem even at low contents, and provide poor analgesic and anti-inflammatory effect.

Lonicera japonica, Swertia japonica, Gentiana scabra, Gentiana triflora, Gentiana manshurica, Gentiana rigescens, and *Gentiana rigescens* French. var. stictantha Marquand have been used for alleviation of fever or detoxification for many years. However, it has not been clearly understood which constituents offer such effects, and most of the researches have been concentrated on identifying the activities of loganin, the major medicinal ingredient of honeysuckle stem [*J. Nat. Prod.*, 54(4), 1102 ~ 1104 , 1991: *Planta Med.*, 60, 232 ~ 234, 1994: *Phytotherapy Res.*, 12, 405-408, 1998].

Further, sweroside has been known as effective only in liver protection and inhibition of bacterial activity [*J. Ethnopharmacol.*, 42, 183-191, 1994: *Chem. Pharm. Bull.*, 45(11), 1823-1827, 1997: *Yakugaku Zasshi*, 102(8), 755-759, 1982], and its anti-inflammatory and analgesic effect has not been reported so far.

SUMMARY OF THE INVENTION

The present inventors have identified that active constituents of honeysuckle stem (stem of honeysuckle where leaves are removed), from which tannins, hardly

soluble flavonoids, saponins, and the like have been removed, and sweroside, the effective active ingredient of the active constituents, have superior anti-inflammatory and analgesic effect.

Accordingly, it is an object of the present invention to provide a preparation method for preparing active constituents from honeysuckle stem, which have superior anti-inflammatory and analgesic activity, safety and stability.

It is another object of the present invention to provide an anti-inflammatory and analgesic drug comprising the active constituents.

It is still another object of the present invention to provide an anti-inflammatory and analgesic drug comprising sweroside.

BRIEF DESCRIPTION OF THE DRAWING

Fig. 1 is a graph that shows medicinal effects of the active constituents depending on their contents.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The present invention provides a method for preparing active constituents from honeysuckle stem, which have superior anti-inflammatory and analgesic activity, safety and stability.

The present invention also provides an anti-inflammatory and analgesic drug comprising the active constituents.

The present invention also provides an anti-inflammatory and analgesic

drug comprising sweroside.

Hereunder is given a more detailed description of the present invention.

The present invention relates to a method extracting and purifying active constituents and sweroside from honeysuckle by removing tannins, hardly soluble flavonoids, saponins, and the like. Thus obtained active constituents have significantly better anti-inflammatory and analgesic effect, are safer and more stable than the conventional active constituents obtained from honeysuckle flower or honeysuckle leaves, and also include sweroside which is an effective active ingredient of anti-inflammatory and analgesic drug.

Active constituents and sweroside are extracted from honeysuckle stem and purified by the following method.

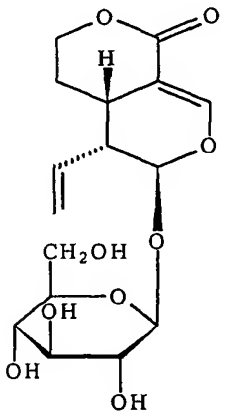
A honeysuckle stem sample is reflux-extracted with about 7 to 10 volumes of distilled water for 2 to 3 hours, and then filtered. The residue is collected and reflux-extracted with about 5 to 7 volumes of distilled water for 2 to 3 hours. Thus obtained liquid is filtered and combined with the above filtrate, concentrated under reduced pressure, and filtered again, so that its volume becomes about 1 to 3 times (v/w) with reference to the herb weight. In extracting with distilled water, if distilled water is used too little, stirring becomes difficult and the extraction efficiency decreases because the solubility of the extract becomes poor. In contrast, if distilled water is used excessively, it requires more time and cost. Then, equivalent water-saturated low grade alcohol is added and stirring is carried out for about 10 to 20 minutes at 30 to 50 rpm. After the layers are separated,

the water-saturated low grade alcohol layer is filtered and concentrated under reduced pressure to obtain primary active constituents. Here, the water-saturated low grade alcohol to be used is prepared by adding distilled water to low grade alcohol, such as propyl alcohol and butyl alcohol, and stirring followed by sedimentation. The process of layer separation is carried out for 2 to 3 times. In obtaining the low grade alcohol solvent fraction, if low grade alcohol is used too little, the purification efficiency decreases, thus the extraction yield and the effective ingredient content decrease. In contrast, if low grade alcohol is used too much, it results in increase in cost. Accordingly, it is recommended to use 1 to 3 volumes (v/w) of low grade alcohol with reference to the herb weight.

A column chromatography is carried out for the primary active constituents using polyamide resin, polyvinylpyrrolidone resin, and the like in order to remove unwanted materials and detect effective ingredient. The filler is used in 1 to 10 volumes (w/w) of the water-saturated low grade alcohol layer. Two three volumes of 50% (v/v) methanol and methanol to the filler volume are eluted, and then the distilled water solvent is eluted by step-gradient method. The secondary active constituents obtained by eluting the active constituents with distilled water had much less aromatic organic acids, tannins and flavonoids, and showed better medicinal effect, significantly reduced toxicity, increased solubility and improved blood stability. A column chromatography is carried out again for the secondary active constituents using ODS (octadecylsilane) resin. Starting from a 10% (v/v) methanol, 2 to 3 volumes of solvent to the resin volume is eluted

by the step-gradient method while increasing the methanol content by 10% (v/v). The polyamide resin or polyvinylpyrrolidone resin is used in 20 to 50 volumes for the weight of the purified primary active constituents. The active constituents obtained by eluting 20 to 30% (v/v) methanol showed the best anti-inflammatory and analgesic effect. Analysis of the active constituents revealed that iridoid substances, such as sweroside and loganin are major active ingredients. The sweroside content was 15.1 to 72.1 wt%, and the loganin content was 13.9 to 41.4 wt%.

The active constituents obtained by eluting 20 to 30% (v/v) methanol has the highest sweroside content. Another column chromatography was carried out for these active constituents to separate sweroside represented by the following Chemical Formula 1:



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For thus obtained active constituents and sweroside, an arachidonic acid induced ear edema test and a croton oil induced ear edema test were carried out to

determine the anti-inflammatory effect. And, an acetic acid induced writhing test was carried out to measure the analgesic effect. As a result, they were found to have much superior inflammatory and analgesic activities than the conventional active constituents obtained from honeysuckle flower or honeysuckle leaves.

The sweroside obtained by the present invention can be prepared into treatment drugs by the methods known in the pharmaceutical circle. And, it can be administered orally or parenterally alone or along with a pharmaceutically acceptable carrier, a forming agent, a diluent, etc. Particularly, it can be prepared in the form of powder, granule, tablet, capsule, syrup, skin ointment or injection drug.

The human dosage of the active constituents or sweroside of the present invention can be selected considering the absorptivity of the active ingredient in the body, inactivation rate and excretion rate, age, sex and physical status of the subject, severity of the disease to be treated, and so forth. Preferably, the active constituents or sweroside are administered from 1 to 200 mg a day for an adult. The drug may be administered according to specialized method, if required by the experts' opinion. The drug may be administered several times a day, preferably 1 to 3 times a day, at regular intervals. The drug composition may be administered orally or non-orally. When the drug is to be administered parenterally, it can be administered through veins, muscles, rectum or skin.

Because the active constituents of honeysuckle stem have superior anti-

inflammatory and analgesic effect and desirable solubility, acute toxicity and blood stability, they are well suited for the injection drug.

Hereinafter, the present invention is described in more detail through the following examples. However, the following Examples are only for the understanding of the present invention, and they shall not be construed as limiting the scope of the present invention.

EXAMPLES

Example 1: Medicinal effects of each part of honeysuckle

Samples of the whole body of honeysuckle (honeysuckle with stem and leaves), honeysuckle leaves and honeysuckle stem were taken at Yeongcheon, Gyeongsangbuk-do, Korea in July 1999. The samples were dried in the shade and reflux-extracted with 7 volumes of distilled water for 2.5 hours, and then filtered. The residue was then collected and reflux-extracted with 7 volumes of distilled water for 2.5 hours. Thus obtained liquid was filtered and combined with the above filtrate, concentrated under reduced pressure, and filtered again, so that its volume became about 2 times (v/w) with reference to the herb weight. Then, equal volume of water-saturated *n*-butyl alcohol was added and the mixture was stirred for 15 minutes at about 30 rpm. After the layers were separated, the alcohol layer was filtered and concentrated under reduced pressure to obtain primary active constituents. Then, a column chromatography was carried out

for obtaining the purified fraction using polyamide resin (CAS NO. 63428-83-1). The resin amount was 5 volumes of the sample. Two volumes of 50% (v/v) methanol and methanol were eluted, and then the distilled water solvent was eluted by step-gradient method to obtain secondary active constituents. A croton oil induced ear edema test was carried out by administering the secondary active constituents of whole body of honeysuckle, honeysuckle stem and honeysuckle leaves into the tail veins of 6-week-old ICR mice (body weight: 20 to 30 g , n = 6, SLC, Japan), which had been fasted for 4 hours. 15 minutes later, inflammation was induced with 2.5% croton oil. 4 hours later, thicknesses of left and right ears of the mice were measured using a dial thickness gauge. The rate of inflammation was calculated by the following Equation 1 and the result is shown in Table 1.

Equation 1

Rate of inflammation (%) = [Thickness of inflamed (right) ear - Thickness of normal (left) ear] / [Thickness of normal ear] × 100

Table 1

Classification	Concentration (mg/kg)	Rate of Inhibition (%)
Whole body of honeysuckle	1	27.6
	3	29.7
	10	34.8
	25	33.6
	50	32.2

Classification	Concentration (mg/kg)	Rate of Inhibition (%)
	100	30.4
Honeysuckle stem	3	30.2
	30	39.0
Honeysuckle leaves	3	19.6
	30	21.9

As shown in Table 1, the active constituents of honeysuckle stem showed best anti-inflammatory and analgesic activity.

Example 2: Comparison of medicinal effect of active constituents obtained from honeysuckle stem

A croton oil induced ear edema test was carried out as in Example 1.

Further, an arachidonic acid induced ear edema test was carried out by administering drugs (marobiven, primary constituents of honeysuckle stem, and secondary active constituents of honeysuckle stem) into the tail veins of 6-week-old ICR mice (body weight: 20 to 30 g , n = 6, SLC, Japan), which had been fasted for 4 hours. Fifteen minutes later, inflammation was induced with 0.05% arachidonic acid. About 1 hour later, thicknesses of left and right ears of the mice were measured, and the rate of inhibition was calculated by Equation 1 and the result is shown in Table 2.

Table 2

Classification	Dose (mg/kg)	Rate of Inhibition (%)	
		CO*	AA**
Control group (marobiven)	50	21:0	NT
	100	25.8	NT
	200	30.1	NT
Primary active constituents	50	35.6	NT
	100	36.2	NT
	200	38.0	NT
Secondary active constituents	0.1	19.8	11.7
	0.3	35.2	16.5
	3	38.0	26.3
	10	36.6	32.4
	30	37.1	48.7

* Croton oil induced ear edema test result

** Test result of arachidonic acid induced ear edema

NT: Not-tested

As shown in Table 2, the secondary active constituents obtained from honeysuckle stem included no compounds like aromatic organic acids, tannins and flavonoids, and had a greater content of active ingredient than the primary active constituents.

Example 3: Comparison of medicinal effects of active constituents obtained from honeysuckle stem

The procedure of Example 1 was carried out by replacing polyamide resin with polyvinylpyrrolidone resin (CAS NO. 25249-54-1).

Table 3

Classification	Dose (mg/kg)	Rate of Inhibition (%)	
		CO*	AA**
Control group (marobiven)	50	20.2	NT
	100	24.1	NT
	200	31.2	NT
Primary active constituents	50	33.2	NT
	100	35.1	NT
	200	37.5	NT
Secondary active constituents	0.1	20.1	10.3
	0.3	34.1	16.7
	3	39.7	24.9
	10	35.6	33.3
	30	36.4	49.6

* Croton oil induced ear edema test result

** Test result of arachidonic acid induced ear edema

NT: Not-tested

Example 4: Preparation of final active constituents and medicinal effect test

The secondary active constituents of honeysuckle stem prepared in Example 1 were concentrated under reduced pressure to obtain a powder. Another column chromatography was carried out for the powder using ODS resin (YMC*GEL ODS-A 12 nm, S-150 m or ODS-AM 12 nm, S-50 m or ODS-AQ 12 nm, S-50 m). Three volumes of resin was used and 20% (v/v) methanol was eluted to obtain the final active constituents.

A croton oil induced ear edema test was carried out as in Example 1.

Further, an acetic acid induced writhing test was carried out by administering drugs (marobiven and the final active constituents of honeysuckle stem) into the tail veins of ICR mice (body weight: 20 to 30 g , n = 8, SLC, Japan), which had been fasted for a day. Twenty minutes later, 0.7% acetic acid was injected intraperioneally. Fifteen minutes later, numbers of writhing for 10 minutes were counted to calculate the rate of inhibiting inflammation. The result is shown in Table 4.

Table 4

Classification	Dose (mg/kg)	Rate of Inhibition (%)	
		CO*	AA**
Control group (marobiven)	1	6.6	37.9
	10	24.0	48.8
	100	29.8	56.5

Classification	Dose (mg/kg)	Rate of Inhibition (%)	
		CO*	AA**
Final active constituents	0.1	29.6	62.1
	1	34.8	68.4
	10	45.8	76.9
* Croton oil induced ear edema test result ** Test result of acetic acid induced writhing NT: Not-tested			

Example 5: Contents of active ingredients and medicinal effect test

From high performance liquid chromatography (HPLC) for the final active constituents prepared in Examples 1 and 4, the contents of active ingredient were identified: sweroside = 15.1 to 72.1 wt% and loganin = 13.9 to 41.4 wt%. The sweroside and loganin contents of each sample are given in Table 5. The medicinal effect of the final active constituents depending on habitat and gathering time are given in Table 6.

Table 5: Contents of sweroside and loganin depending on habitat and time of collection

Month	Yeongcheon, Gyeongsangbuk-do (A)	Andong, Gyeongsangbuk-do (B)	Taishan, China	Xinxiang, China

Month	Yeongcheon, Gyeongsangbuk-do (A)	Andong, Gyeongsangbuk-do (B)	Taishan, China	Xinxiang, China
January	Lo: 34.6 Sw: 57.7 Total: 92.3	Lo: 38.3 Sw: 55.4 Total: 93.7	Lo: 38.2 Sw: 48.6 Total: 86.8	Lo: 31.4 Sw: 59.2 Total: 90.6
February	Lo: 30.2 Sw: 64.1 Total: 94.3	Lo: 32.3 Sw: 62.1 Total: 94.4	Lo: 33.3 Sw: 54.2 Total: 87.5	Lo: 28.6 Sw: 63.3 Total: 91.9
March	Lo: 22.7 Sw: 70.2 Total: 92.9	Lo: 26.1 Sw: 67.6 Total: 93.7	Lo: 25.8 Sw: 60.3 Total: 86.1	Lo: 20.5 Sw: 72.1 Total: 92.6
April	Lo: 13.9 Sw: 63.1 Total: 77.0	Lo: 15.9 Sw: 60.1 Total: 76.0	Lo: 19.1 Sw: 65.3 Total: 84.4	Lo: 14.2 Sw: 69.7 Total: 83.9
May	Lo: 17.1 Sw: 52.3 Total: 69.4	Lo: 14.2 Sw: 55.7 Total: 69.9	Lo: 18.7 Sw: 66.2 Total: 84.9	Lo: 14.9 Sw: 55.2 Total: 70.1
June	Lo: 19.4 Sw: 33.4 Total: 52.8	Lo: 16.2 Sw: 38.2 Total: 54.4	Lo: 23.5 Sw: 43.5 Total: 67.0	Lo: 17.4 Sw: 42.6 Total: 60.0
July	Lo: 21.7 Sw: 15.1 Total: 36.8	Lo: 25.3 Sw: 17.5 Total: 42.8	Lo: 28.9 Sw: 29.8 Total: 58.7	Lo: 22.4 Sw: 35.2 Total: 57.6

Month	Yeongcheon, Gyeongsangbuk-do (A)	Andong, Gyeongsangbuk-do (B)	Taishan, China	Xinxiang, China
August	Lo: 23.5 Sw: 29.4 Total: 52.9	Lo: 27.0 Sw: 32.7 Total: 59.7	Lo: 30.1 Sw: 35.9 Total: 66.0	Lo: 32.1 Sw: 36.4 Total: 68.5
September	Lo: 25.3 Sw: 47.6 Total: 72.9	Lo: 30.1 Sw: 45.3 Total: 75.4	Lo: 33.6 Sw: 42.5 Total: 76.1	Lo: 39.2 Sw: 40.2 Total: 79.4
October	Lo: 28.7 Sw: 52.2 Total: 80.9	Lo: 32.2 Sw: 50.5 Total: 82.7	Lo: 33.8 Sw: 48.2 Total: 82.0	Lo: 37..4 Sw: 43.3 Total: 80.7
November	Lo: 39.6 Sw: 54.3 Total: 93.9	Lo: 37.3 Sw: 58.3 Total: 95.6	Lo: 38.0 Sw: 54.6 Total: 92.6	Lo: 41.4 Sw: 45.6 Total: 87.0
December	Lo: 36.2 Sw: 56.8 Total: 93.0	Lo: 33.7 Sw: 60.2 Total: 93.9	Lo: 35.2 Sw: 58.3 Total: 93.5	Lo: .40.2 Sw: 52.6 Total: 92.8

Lo: Loganin, Sw: Sweroside

Table 6

Classification	Contents (mg/kg)	Rate of Inhibition (%)	
		CO*	AA**
Control group (marobiven)	10	25.6	46.9
	100	28.8	56.8
Yeongcheon, July Lo: 21.7, Sw: 15.1 Total: 36.8	1	37.2	70.2
	10	46.3	75.1
Andong, July Lo: 25.3, Sw: 17.5 Total: 42.8	1	40.3	72.2
	10	51.2	84.3
Xinxiang, July Lo: 22.4, Sw: 35.2 Total: 57.6	1	49.8	78.8
	10	52.6	85.6
Taishan, September Lo: 33.6, Sw: 42.5 Total: 76.1	1	52.1	82.9
	10	52.4	85.5
Andong, November Lo: 37.3, Sw: 58.3 Total: 95.6	1	53.4	84.6
	10	53.2	87.7

* Croton oil induced ear edema test result

** Test result of acetic acid induced writhing

Example 6: Hemolysis test for final active constituents

Twenty mL of blood was collected from a rabbit's heart using a syringe treated with heparin. The blood was centrifuged for about 10 minutes. The supernatant was discarded and the residue was diluted with 10 volumes of physiological salt solution for injection. After mixing by gentle shaking, 0.5 mL of the diluted blood and 0.5 mL of each drug of Example 1 (final active constituents of honeysuckle stem and primary active constituents of honeysuckle stem, honeysuckle leaves and whole body of honeysuckle) and the final active constituents of Example 4 were put in a test tube (Physiological salt solution and distilled water (100 % hemolysis) control groups were also prepared). The test tube was incubated in a bath kept at 37 ℃ for 15 minutes, and then placed at room temperature for 45 minutes. Lastly, after centrifuge at 2500 rpm for 2 minutes, the upper layer was analyzed at 540 nm.

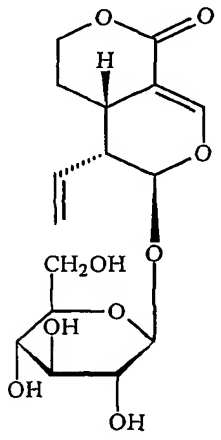
Table 7

Classification	Hemolysis (%)	Standard deviation
Control group (physiological salt solution for injection)	0.73	0.17
Final active constituents, 5×10^{-4} g/mL	0.69	0.10
Final active constituents, 1.5×10^{-3} g/mL	0.73	0.11
Final active constituents, 5×10^{-3} g/mL	0.74	0.88
Honeysuckle stem, 5×10^{-3} g/mL	15.2	0.20

Honeysuckle leaves, 5× 10^{-3} g/mL	35.1	0.15
Whole body of honeysuckle, 5× 10^{-3} g/mL	23.0	0.45

Example 7: Preparation of sweroside

A column chromatography was carried out for the final active constituents prepared in Example 4 using octadecylsilane resin to separate sweroside represented by the following Chemical Formula 1:



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Example 8: Determination of anti-inflammatory effect of sweroside

A croton oil induced ear edema test was carried out by administering sweroside into the tail veins of 6-week-old ICR mice (body weight: 20 to 30 g, n = 6, SLC, Japan), which had been fasted for 4 hours. Fifteen minutes later, inflammation was induced with 2.5% croton oil. Four hours later, thicknesses of left and right ears of the mice were measured using a dial thickness gauge. The rate of inflammation was calculated by Equation 1 and the result is shown in Table 8.

The medicinal effect for oral administration is given in Table 9.

Table 8

Classification	Dose (mg/kg)	Rate of Inhibition (%)
Sweroside	0.1	49.8
	1	56.2
	10	65.7

Table 9

Classification	Dose (mg/kg)	Rate of Inhibition (%)
Sweroside	1	31.9
	10	43.1
	100	57.8

Further, an arachidonic acid induced ear edema test was carried out by administering sweroside into the tail veins of 6-week-old ICR mice (body weight: 20 to 30 g, n = 6, SLC, Japan), which had been fasted for 4 hours. Fifteen minutes later, inflammation was induced with 0.05% arachidonic acid. One hour later, thickness of left and right ears of the mice was measured, and the Rate of Inhibition was calculated by the Equation 1 and the result is shown in Table 10. The medicinal effect for oral administration is given in Table 9.

Table 10

Classification	Dose (mg/kg)	Rate of Inhibition (%)
Sweroside	0.1	48.3
	1	55.1
	10	69.1

Table 11

Classification	Dose (mg/kg)	Rate of Inhibition (%)
Sweroside	1	29.0
	10	34.7
	100	45.7

Example 9: Determination of analgesic effect of sweroside

An acetic acid induced writhing test was carried out by administering sweroside into the tail veins of ICR mice (body weight: 20 to 30 g , n = 8, SLC, Japan), which had been fasted for a day. Twenty minutes later, 0.7% acetic acid was injected intraperioneally. Fifteen minutes later, the number of writhing for 10 minutes were counted to calculate the rate of inhibiting inflammation and the result is shown in Table 12. The medicinal effect for oral administration is given in Table 13.

Table 12

Classification	Dose (mg/kg)	Rate of Inhibition (%)
Sweroside	0.1	74.6
	1	86.4
	10	89.7

Table 13

Classification	Dose (mg/kg)	Rate of Inhibition (%)
Sweroside	1	65.9
	10	79.1
	100	87.9

Example 10: Toxicity Test

The active constituents of honeysuckle stem and sweroside, in the amount of 1.0 g/kg, 1.5 g/kg and 2.0 g/kg, were administered through the tail veins of SD rats (body weight: 120 to 170 g, 5 male and female rats for each administration dose, SLC, Japan), respectively, which had been fasted for 4 hours. The rats were observed for 30 minutes at first, and then observed at 30 minutes intervals with naked eyes. Death rate, general symptoms and weight change were observed for 2 weeks after administration. An autopsy was conducted to identify presence of any abnormalities of organs.

The lethal dose of the active constituents of honeysuckle stem and sweroside was both over 5.0 g/kg for oral administration (no dead rats observed), and over 2.0 g/kg for intravenous injection (no dead rats observed). When 2.0 g/kg was intravenously injected, the rats showed increased respiration counts and decreased activity for about 10 minutes, which were restored soon. No other symptoms were observed, and there was no change in weight due to administration. The autopsy result showed no abnormalities as is the case with the control groups.

A local toxicity test at the dose of 50, 100 and 150 mg/kg, respectively, showed no difference from the group administered with physiological salt solution. No toxicity, such as tissue necrosis or inflammation, was observed.

Preparation Example 1: Preparation of tablet

The active constituents of honeysuckle stem or sweroside was prepared into a tablet with the following composition:

Active ingredient	160 mg
Light anhydrous silicic acid	20 mg
Corn starch	87 mg
Crystalline cellulose	72 mg
Sodium starch glyconate	60 mg
Magnesium stearate	6 mg
Total	672 mg

Preparation Example 2: Preparation of syrup

The active constituents of honeysuckle stem or sweroside was prepared into syrup with the following composition:

Active ingredient	4,000 mg
Methyl *p*-oxybenzoate (5% ethanol solution)	60 mg
Propyl *p*-oxybenzoate (5% ethanol solution)	40 mg
Sodium benzoate (5% solution)	100 mg
Banana powder (10% solution)	600 mg
D-Sorbitol	140,000 mg
Distilled water	196 mL

Preparation Example 3: Preparation of injection

The active constituents of honeysuckle stem or sweroside was prepared into an injection with the following composition:

Injection ampule:	Active ingredient	20 mg
	Mannitol	60 mg
Corresponding solvent sample:		
	Physiological salt solution for injection	2000 mg
	Total	2080 mg

Preparation Example 4: Preparation of injection

The active constituents of honeysuckle stem or sweroside was prepared into

an injection with the following composition:

Injection ampule:	Active ingredient	50 mg
	$KH_2(PO_4)$	8.5 mg
	Physiological salt solution for injection	3000 mg
	Total	3058.5 mg

Preparation Example 5: Preparation of injection

The active constituents of honeysuckle stem or sweroside was prepared into an injection with the following composition:

Injection ampule:	Active ingredient	100 mg
	Mannitol	300 mg
	$KH_2(PO_4)$	17 mg
	Physiological salt solution for injection	3000 mg
	Total	3417 mg

Preparation Example 6: Preparation of ointment drug

The active constituents of honeysuckle stem or sweroside was prepared into an ointment drug the following composition:

Active ingredient	5 g
Liquid paraffin	10 g
Hard lead	9 g
Ethanol	8 g

Sorbitan monooleate	2 g
Polysorbate	4 g
Propyl *p*-oxybenzoate	0.05 g
Methyl *p*-oxybenzoate	0.1 g
Concentrated glycerine	10 g
Purified water	Adequate

As described above, the active constituents of the present invention obtained from honeysuckle stem have significantly increased solubility and blood stability as compared to those of the conventional active constituents. Further, they are shown to have superior analgesic and anti-inflammatory effect, safety and stability. Also, sweroside of the present invention obtained from honeysuckle stem has very superior medicinal effect and shows little toxicity, thus being very suitable for an anti-inflammatory and analgesic drug.

While the present invention has been described in detail with reference to the preferred embodiments, those skilled in the art will appreciate that various modifications and substitutions can be made thereto without departing from the spirit and scope of the present invention as set forth in the appended claims.